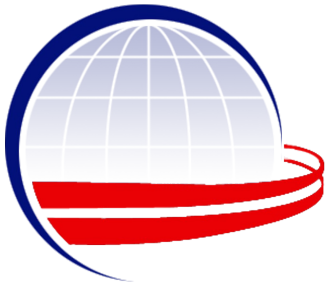
Horizontal Fusion Services-Oriented Architecture

Travis Putvain

HF Management Team



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CATALYST FOR NET-CENTRIC TRANSFORMATION • DEPARTMENT OF DEFENSE

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Integration and Horizontal Fusion

- **Horizontal Fusion is focused on the building of a services-oriented architecture which supports DoD Operations (SIPRNet). Key components of this architecture are:**
  - **Mars Portal**
  - **Collateral Space**
    - **Web-enabled data**
    - **Web-enabled services**

} Portfolio membership

- **Key integration principles need to be followed for this architecture to function properly**
  - **Standards must be followed**
  - **Specifications must be used**
  - **Core enterprise services must be leveraged**

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Mars Portal

- **A user entry point into the Collateral Space**
- **Portfolio members will have a direct and/or indirect interaction with the Portal**
  - **Direct interaction means a user can directly leverage Portfolio members' web-enabled data and/or service's from the Portal**
    - **Requires a portlet to be developed by the Portfolio member**
  - **Indirect interaction means that your data and/or services are leveraged through the core enterprise services**
    - **i.e. implementation of the Federated Search specification**
- **How data and services are represented is user defined (can come in multiple flavors)**
  - **i.e. thick client COP and OS WebCOP see the same data**

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Mars Portal

- **Description:**
  - **Portal Framework Software: BEA Web Logic 8.1 Service Pack 2 (SP2)**
- **Specifications:**
  - **All portlets will be JSR-168 compliant**
- **Plan:**
  - **Initially, SPAWAR will host all portlets**
    - Integration Team will investigate remote portlet implementation using BEA 8.1 SP2 and Web Services for Remote Portlets (WSRP) standard (allow local hosting of portlet)
  - **Portal Engineering**
    - Performance Tuning/Optimization (ongoing)
    - Portal rendering/refresh issues - BEA identified potential solution
    - User Interface Synchronization (e.g., CSS), Configuration
      - Skins
      - Workspace configuration, modification, profiles
        - » Solution potentially tied to portal rendering/refresh issues

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Standards

- **Data standards**
  - **Ontologies/Taxonomies**
  - **Data specifications (Track, Person, Geo-spatial) will lead to the metadata tagging standards to be followed**
    - **i.e. security elements**
- **Service standards**
  - **Specifications for the Horizontal Fusion services**
    - **Core Enterprise**
    - **Initiative provided**
- **Technology standards**
  - **Implemented commercial technology standards (i.e. JSR-168 Portlet standard, HTML, XML)**
- **Thin client standards**
  - **Netscape, Microsoft Internet Explorer**

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Definitions

- **Ontologies and Taxonomies – What are they and how do we use them?**
  - **Ontology – a formal model of the data that exists within any domain. The main focus of these models are classes, instances of classes, attributes of classes and relationships between classes**
  - **Taxonomy – a hierarchy of categories with the root of the hierarchy being the most general and the leaves being the most specific**
- **Once ontologies and taxonomies are developed, they are leveraged by core enterprise services**
  - **Help us define and refine the data in the Collateral Space**
  - **Ontology used to properly register data sources**
  - **Federated Search uses ontology to scope which data sources will provide best answer to user query**

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Taxonomy Example

- **Alcoholic Grape-based Beverages – Wine, Champagne**
  - **Region(1) – Eastern United States, Western United States**
  - **Region(2) – France, California, Oregon, Washington, etc.**
  - **Region(3) – Bordeaux, Napa Valley, Sonoma, etc.**
  - **Vineyard – Beringer, Stags Leap, Yellow Tail, etc.**
  - **Color – Red, White, Blush**
  - **Sparkling/Non-sparkling**
  - **Year Bottled**
  - **Type – Merlot, Riesling, Chardonnay, Cabernet, etc.**

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Ontology Example

- **Gwen's Wine Cellar**
  - **Only Californian**
  - **Vineyard – Beringer, Stags Leap, Kendall Jackson, Gallo, etc.**
  - **Only white**
- **Andrew's Wine Cellar**
  - **All regions**
  - **Red and whites**
  - **Type – Merlot, Riesling, Cabernet**

- **Alcoholic Grape-based Beverages – Wine, Champagne**
  - **Region(1) – Eastern United States, Western United States**
  - **Region(2) – California, Oregon, Washington, etc.**
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  - **Year Bottled**
  - **Type – Merlot, Riesling, Chardonnay, Cabernet**

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Definitions

- **Metadata tagging - What is it and how do we use it?**
  - **Metadata is data about data**
    - **Any type of information that elaborates or explains data. The simplest form is a name/value pair; for example, name = “mike”**
  - **Usages**
    - **Categorization of data**
    - **Security**
    - **Document level mark up**

Metadata tagging provides a simple description about

potentially complex structured and unstructured text

for quick reference and lookup through

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Core Enterprise Services

- Security
- Service Discovery (UDDI)
- Content Discovery (Federated Search)
- Person Discovery
- Messaging
- Collaboration
- C2 Visualization
- Enterprise Service Management (ESM) *
- Metadata Discovery *
- Storage (WebDAV) *

ot scheduled for wide-scale deployment in 2004

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Security Services

- **Description:**
  - **Single Sign-On**
    - **PKI Certificate for identity**
  - **Role Based Access**
  - **Enhanced security features through customized views and capabilities based on role and user profile**

nitiative is required to implement Security Services

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The Actual Definitions

- **Mandatory Access Control (MAC)**
  - **“A means of restricting access to objects based on the sensitivity of the information contained in the objects and the formal authorization (i.e., clearance, formal access approvals, and need-to-know) of subjects to access information of such sensitivity.”**

- **Discretionary Access Control (DAC)**
  - **“A means of restricting access to objects (e.g., files, data entities) based on the identity and need-to-know of subjects (e.g., users, processes) and/or groups to which the object belongs. The controls are discretionary in the sense that a subject with a certain access permission is capable of passing that permission (perhaps indirectly) on to any other subject (unless restrained by mandatory access control).”**

- DCID 6/3 dtd 3 MAY 2002

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Boiling It Down

- **Mandatory Access Controls (MAC)**
  - **Restricting access to objects based on known/provided attributes:**
    - **Identity**
    - **Clearance**
    - **Formal access approvals**
    - **Need-to-know**

- **Discretionary Access Control (DAC)**
  - **Restricting access to objects based on known/provided attributes:**
    - **User ID/Password**
    - **File permissions (granted by anyone)**

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What's That Really Mean for ALL Initiatives?

- **MANDATORY to use Net-Centric Enterprise Services (NCES) Security Services (NSS) to authenticate users as per the specification**
- **MANDATORY to label all data/XML/SOAP requests with relevant classification information**
- **MANDATORY to restrict access (where applicable) based on that user's attributes**
- **MANDATORY not to regrade data classification on an object without appropriate authority by operational commander**
  - **ALL label changes need to be audited**

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NCES Security Services Specification Compliant Services

- **Description:**
  - **Certificate Validation Service** – Allows the validity of a principal's credentials (PKI certificates) to be verified. This service is used by the Security Handler to ensure that a given set of credentials has not been revoked and is still valid
  - **Policy Retrieval Service** – Allows Access Control Lists (ACLs) to be retrieved
  - **Policy Administration Service** – Allows Access Control Lists (ACLs) to be Created, Updated and Deleted. This service provides a central mechanism for the storage of ACLs for Web Services and for other managed resources and data
  - **Principal Attribute Service** – A *principal* is a person, object, device, server or other entity that consumes a Resource. The Principal Attribute Service allows consumers to retrieve attributes about principals within the system
  - **Policy Decision Service** – This service allows consumers to authorize principals that are attempting to access resources within the system. Both the validity of the principal's credentials and the validity of the message are checked. The Policy Management Service may be called in order to check the ACL for the given resource, and the Key Management Service may be called to ensure the validity of the message communication

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Security Services

- **Specifications:**
  - **Produced**
    - V0.3 Security Services WSDL Specifications FINAL dated Feb 9, 2004
    - V0.3 Security Services Architecture Document FINAL dated Mar 1, 2004
    - V0.3 Security Services and SDK Release FINAL dated Apr 1, 2004
  - **Future Release**
    - V0.4 Security Services WSDL Specifications FINAL dated Apr 23, 2004
    - V0.4 Security Services Release SCHEDULED dated May 20, 2004

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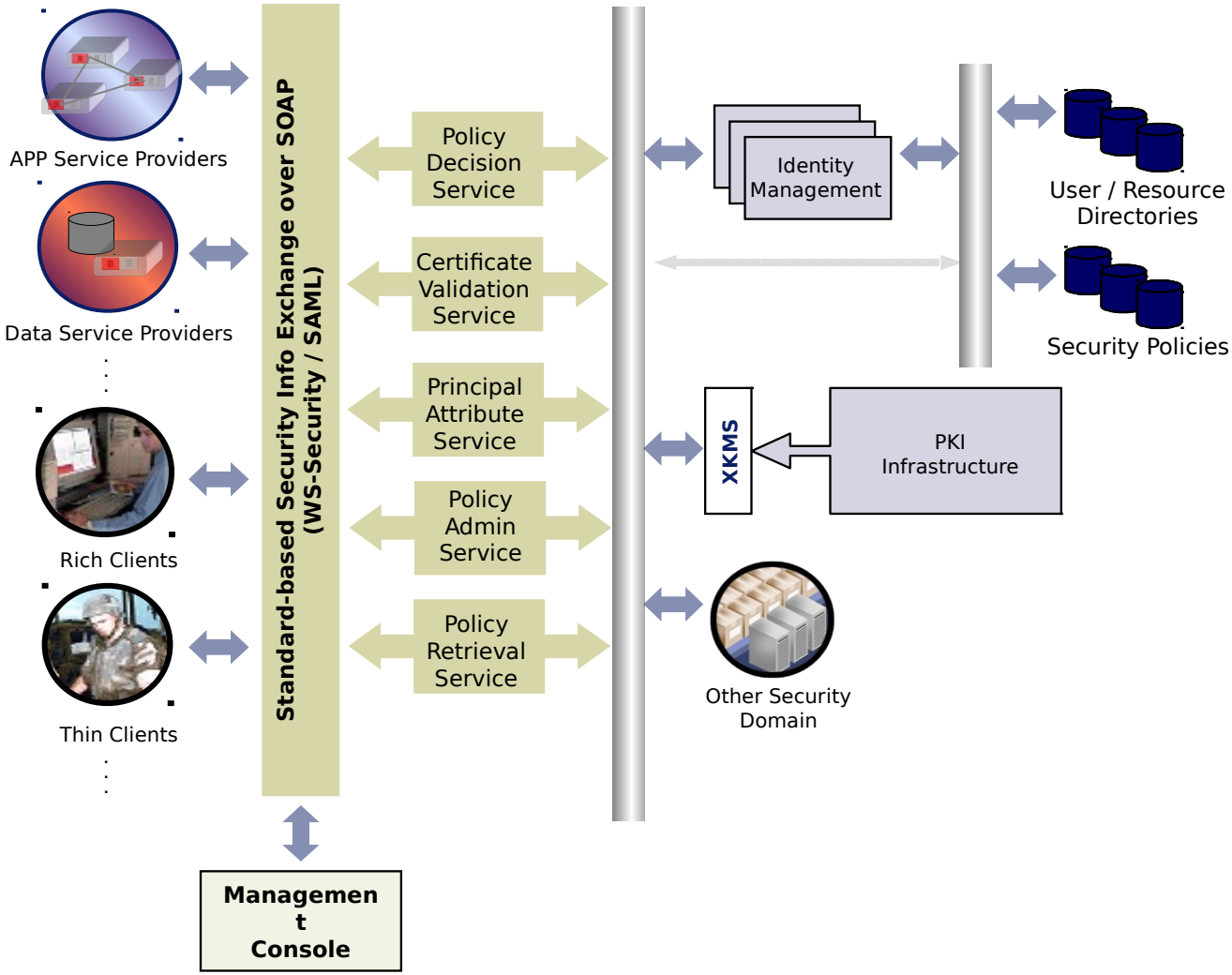
Security Services: Architecture



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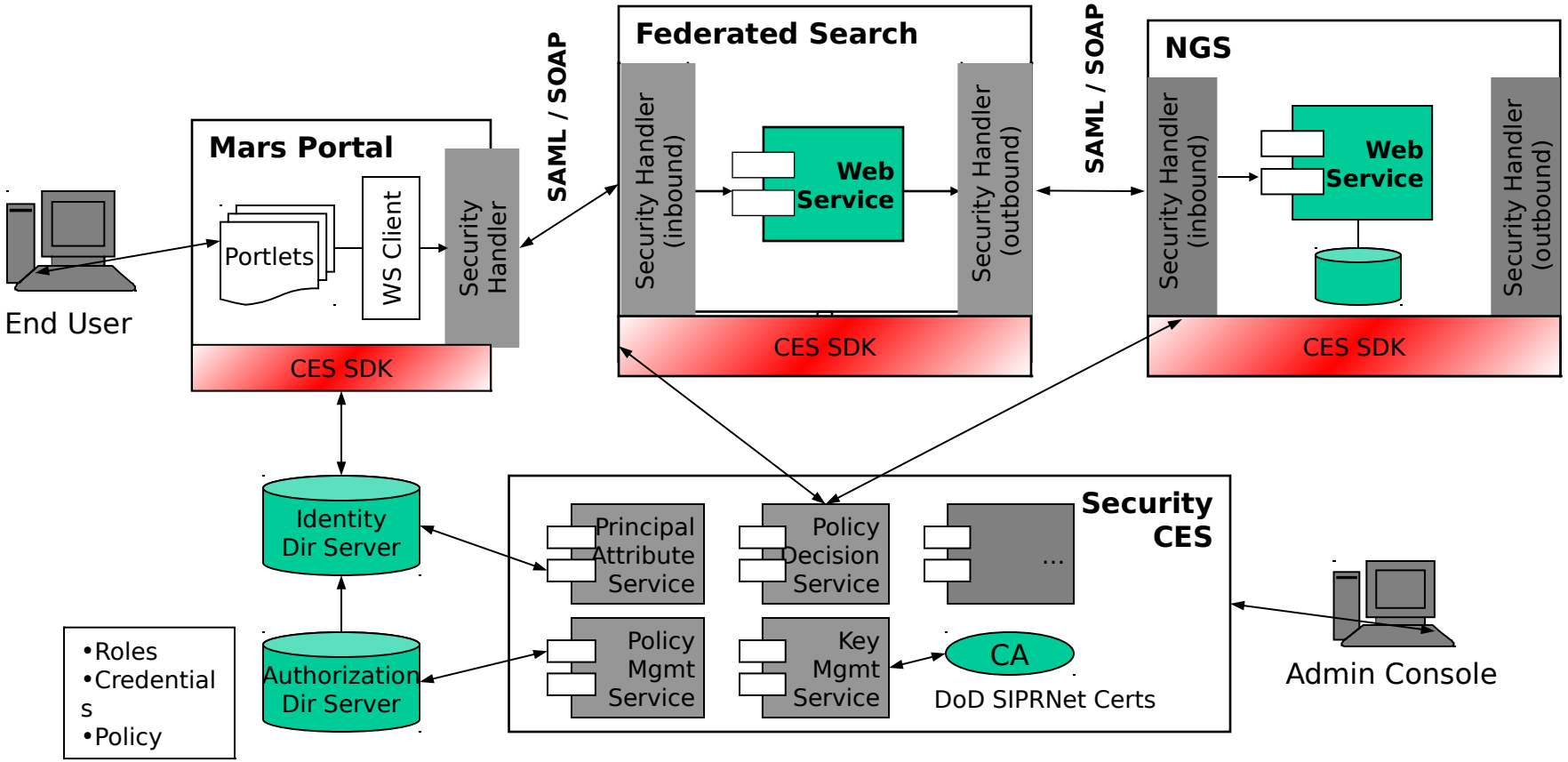
Security Services: Use Case



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Service Discovery

- **Description:**
  - **Single point for web service registration**
  - **Single point for web service discovery**
  - **Universal Description, Discovery, and Integration (UDDI)**

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Services Discovery

- **Description:**
  - **NCES defined:**
    - **Publishing Service** – Allows the management of Web Service entries in a UDDI or other service registry. A service registry contains a listing of Web Services for a given domain, and this service allows Web Service listings to be added, deleted, modified, etc.
    - **Discovery Service** – Allows Web Services listing in a UDDI or other registry to be discovered. This service allows for consumers to discover the existence of services, as well as to see metadata and other information about the listed services
  - **Horizontal Fusion defined:**
    - Use commercial standard
      - **Java XML API for Registries (JAXR)**
      - **UDDI v2.0 SOAP/XML**
- **Specifications:**
  - **Produced**
    - V0.3 NCES Service Discovery Specifications FINAL dated Feb 15, 2004
    - JAXR V1.0
  - **Consumed**
    - UDDI v2.0

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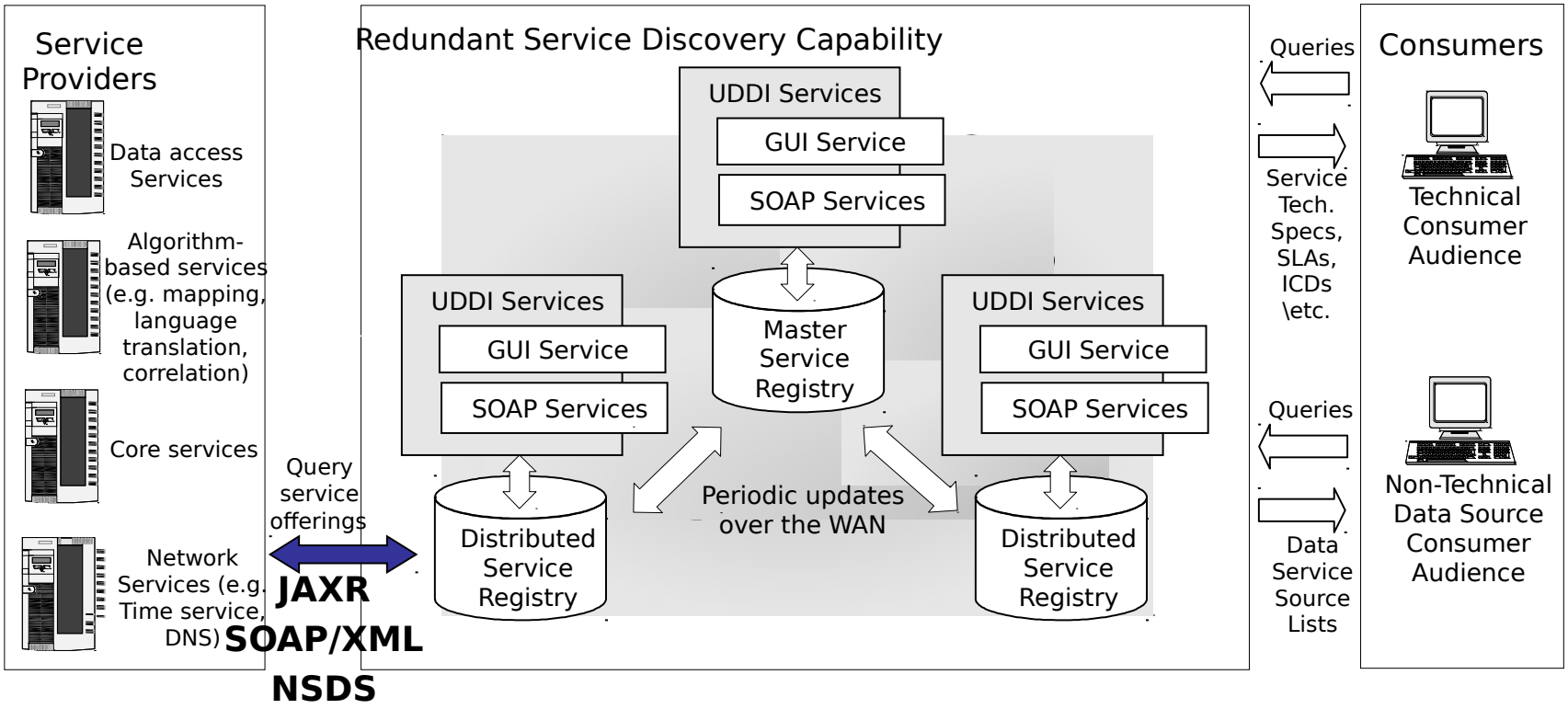
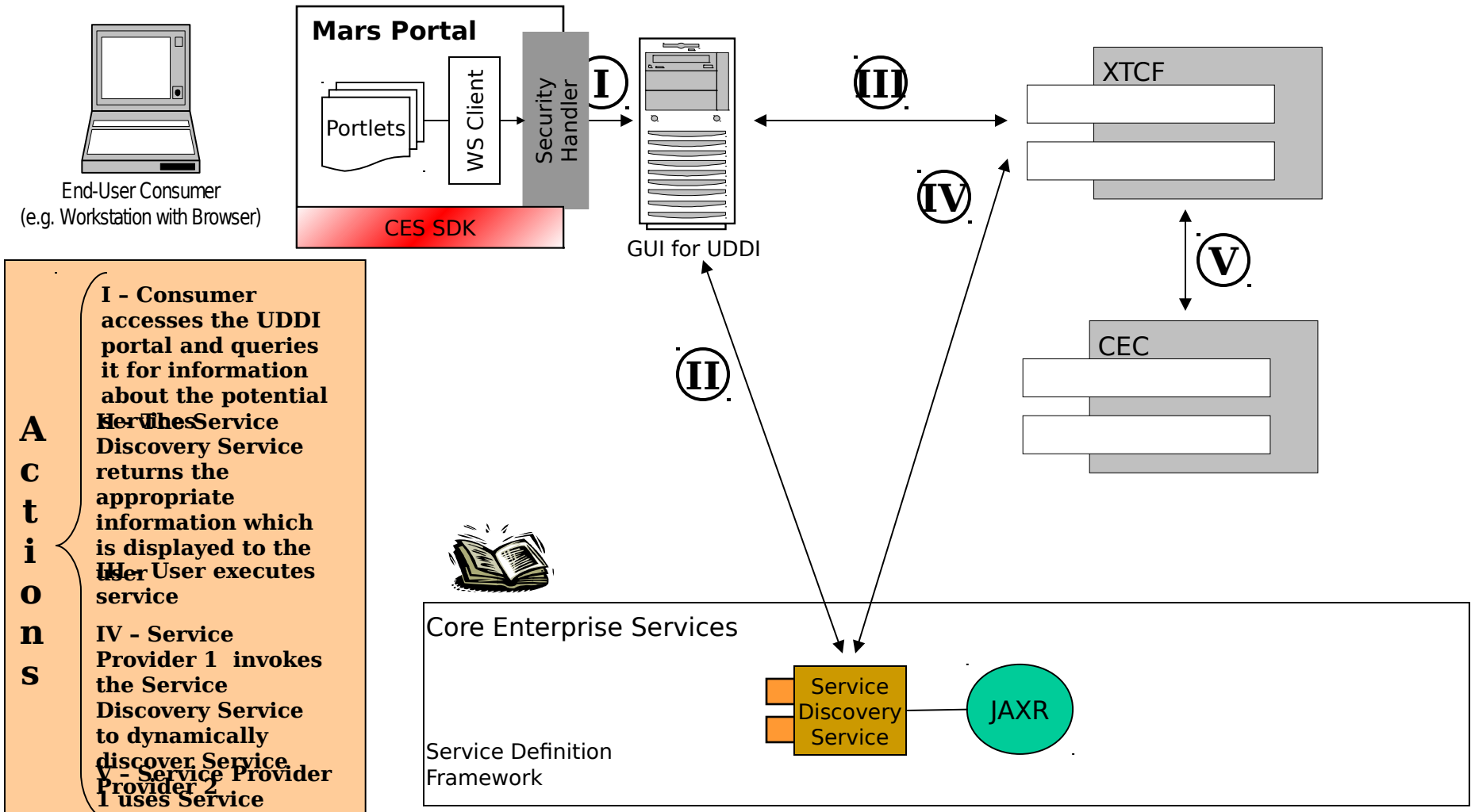
Services Discovery: Architecture



Service Discovery: Use Case



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Content Discovery

- **Description:**
  - **Users access data sources in the Collateral Space**
  - **Ability to execute a Military Language Understanding Smart search across federated data stores**
  - **Search Web Service supports interoperability and extensibility by providing consistent interface to data providers and visualization components**
  - **Registration Web Service supports intelligent routing by providing a means for data providers to register with the routing ontology**
- **Specifications:**
  - **Produced**
    - V1.2 Search Web Service Specifications FINAL dated Apr 13, 2004
    - V1.1 Registration Web Service Specifications FINAL dated Apr 13, 2004
  - **Consumed**
    - DoD Discovery Metadata Specification XML alpha schema implementation
    - V0.3 Security Services WSDL Specifications FINAL dated Feb 9, 2004

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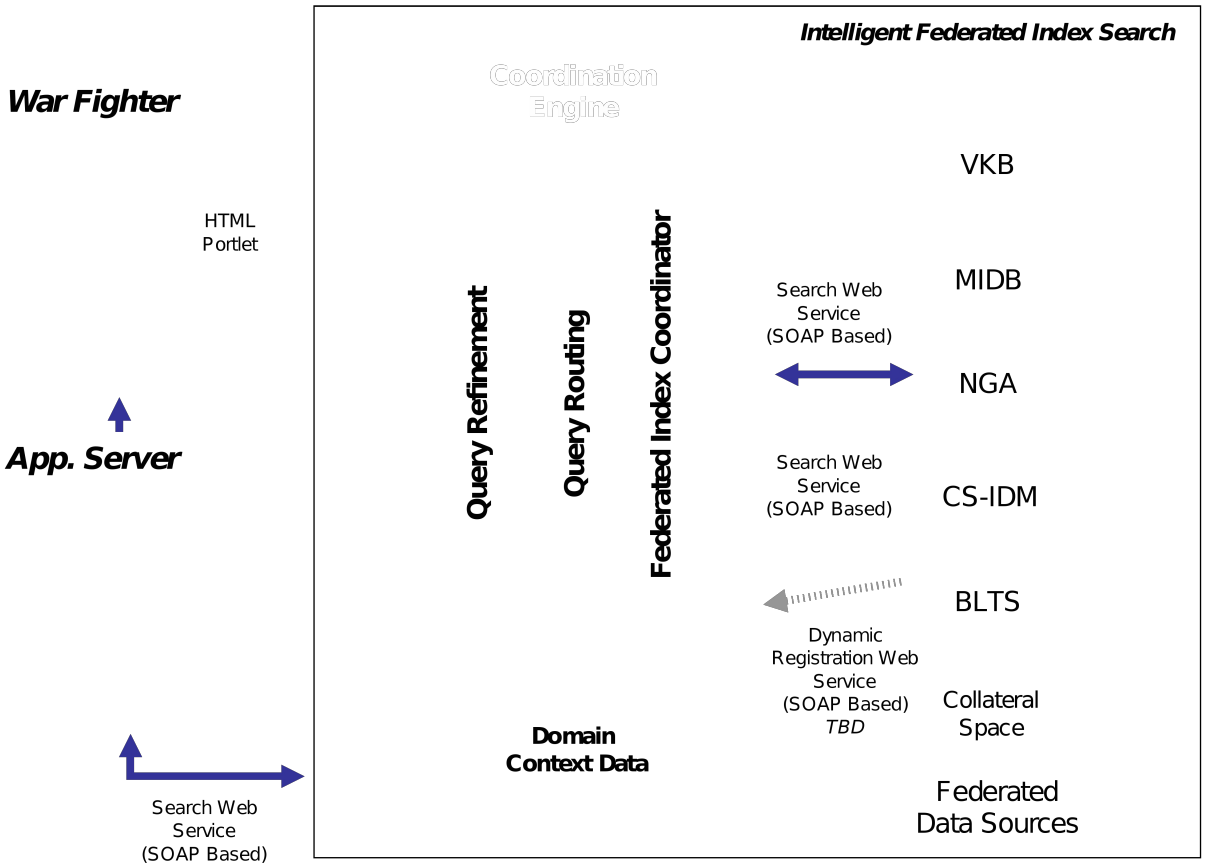
Content Discovery: Architecture

Net Centric Conceptual Overview



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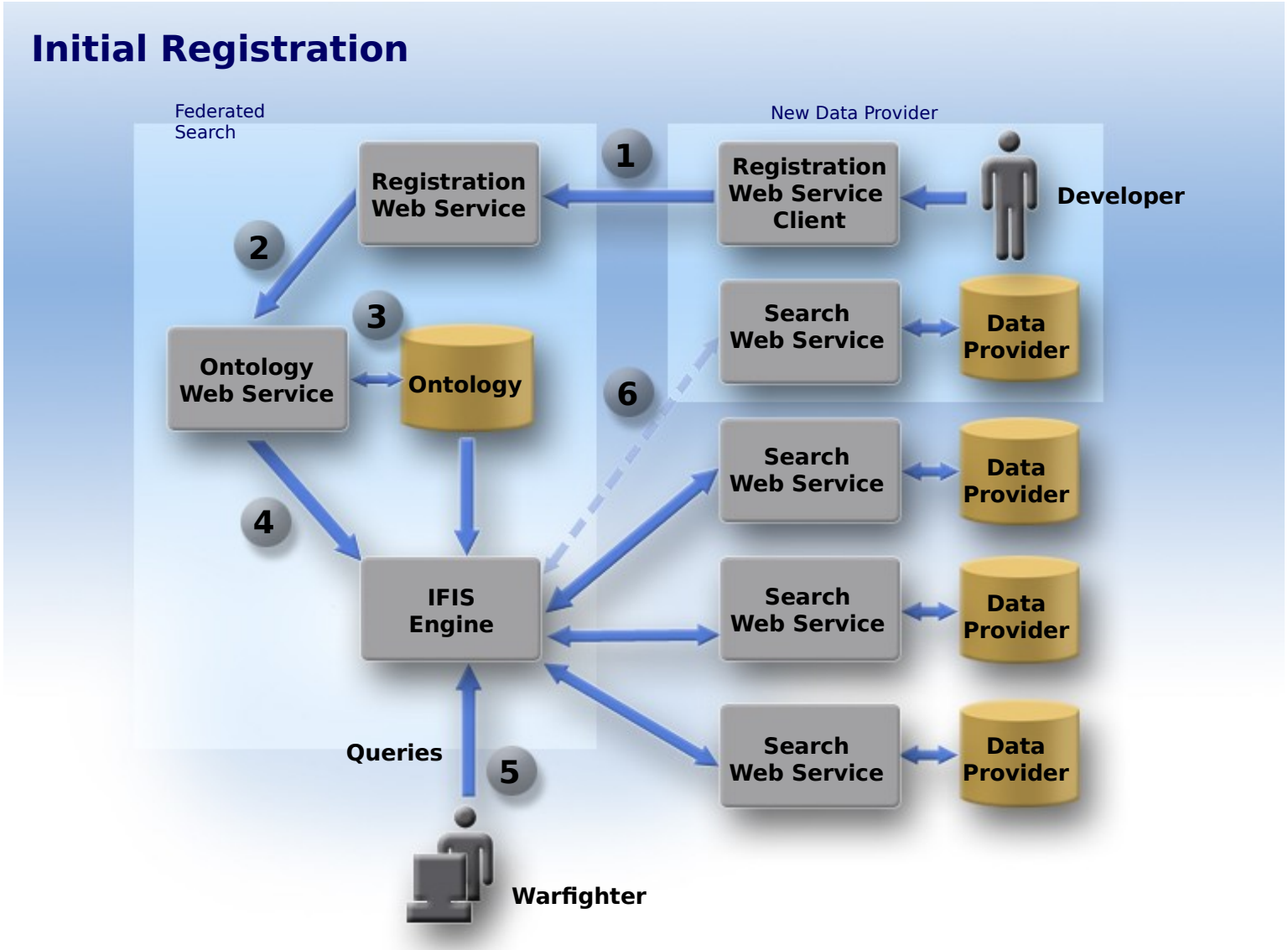
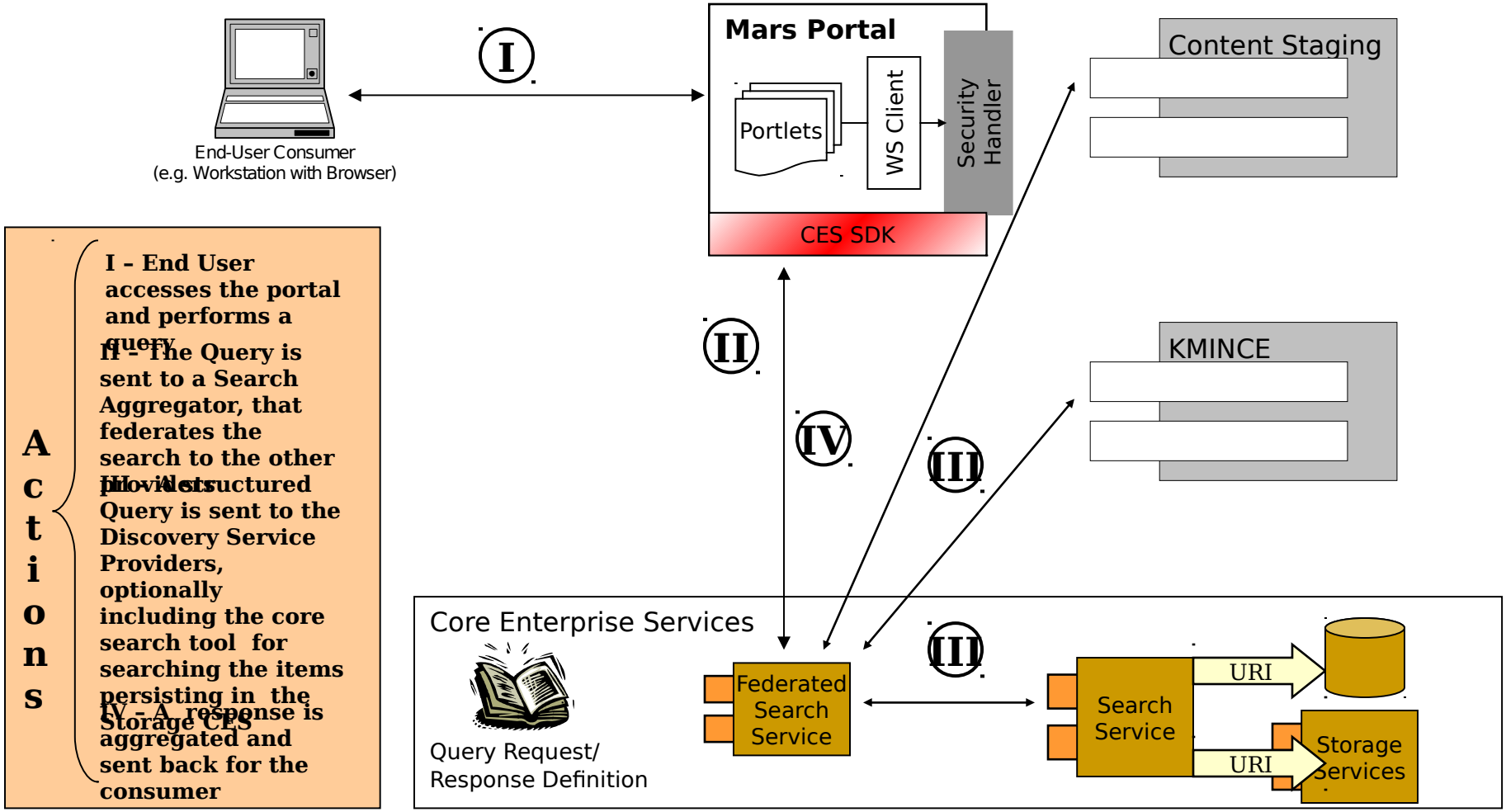
Content Discovery: Ontology Registration

Initial Registration



Content Discovery: Use Case


End-User Consumer
(e.g. Workstation with Browser)
I
Mars Portal
Portlets
WS Client
Security Handler
CES SDK
Content Staging
KMINCE
II
III
IV
Core Enterprise Services
Federated Search Service
Search Service
URI
URI
Storage Services
Query Request/
Response Definition
Actions
I – End User accesses the portal and performs a query
II – The Query is sent to a Search Aggregator, that federates the search to the other providers
III – A structured Query is sent to the Discovery Service Providers, optionally including the core search tool for searching the items persisting in the Storage CES
IV – A response is aggregated and sent back for the consumer

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Person Discovery

- **Description:**
  - **Enables searching on selected attributes concerning the full spectrum of the DoD personnel to include civilian, contractor, active duty, reserve etc.**
  - **Plan is to extend Lightweight Directory Access Protocol (LDAP) server to support person attributes currently not within Global Directory Service (GDS) LDAP**

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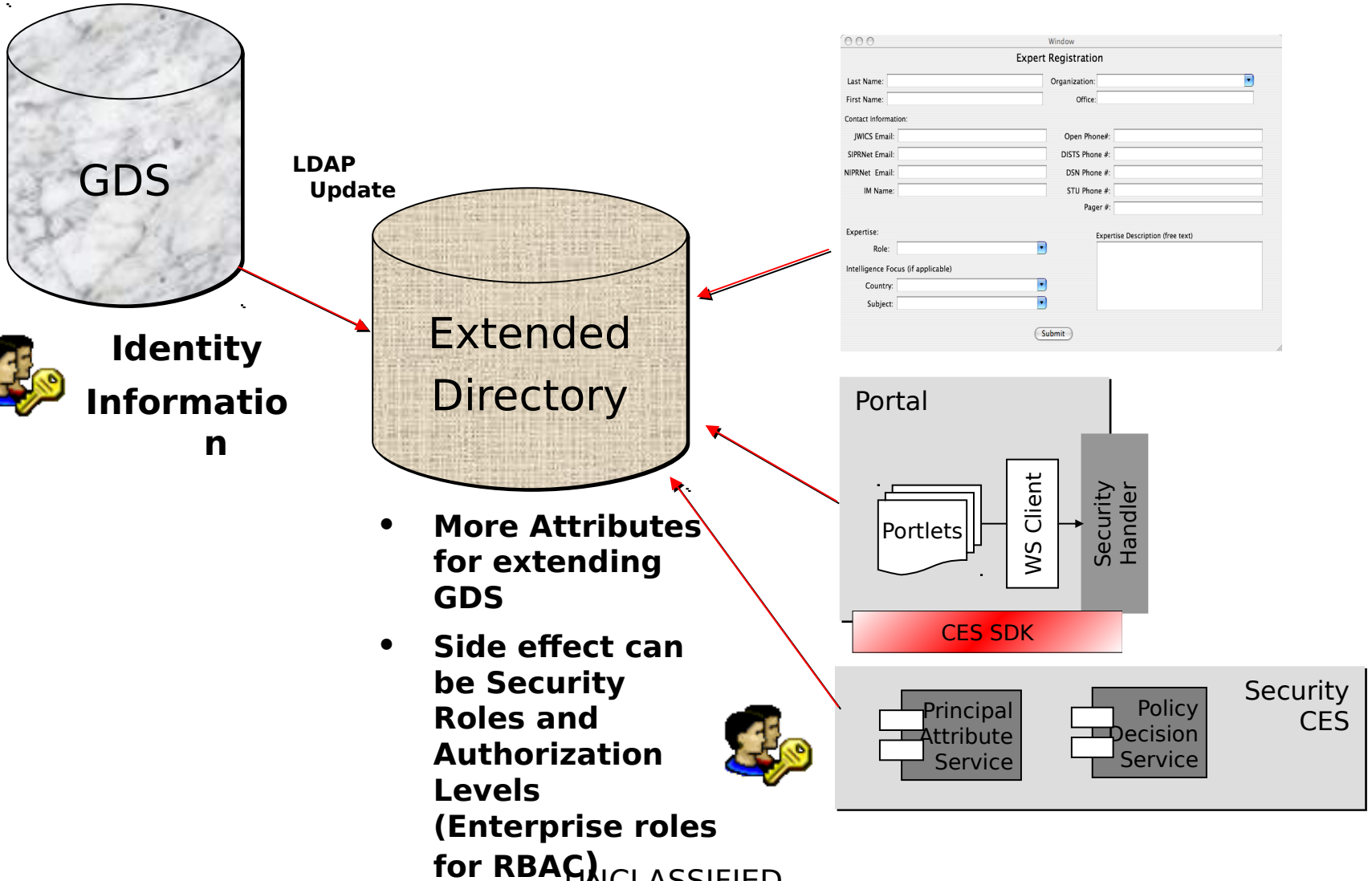
Person Discovery

- **Description:**
  - **Enables searching on selected attributes concerning the full spectrum of the DoD personnel to include civilian, contractor, active duty, reserve etc.**
  - **Plan is to extend Lightweight Directory Access Protocol (LDAP) server to support person attributes currently not within Global Directory Service (GDS) LDAP**
  - **Registering and Finding Expert Information for Expert Personnel**
    - Contact Data and other Information
  - **A repository of users and security role information about HF users**

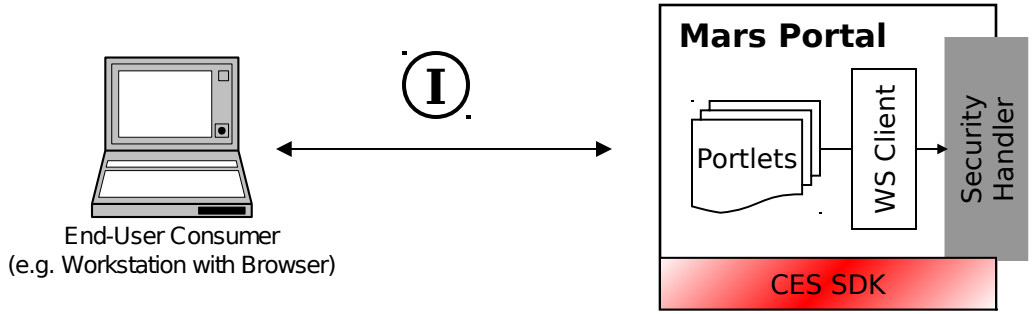
- **Specifications:**
  - **Produced**
    - V 1.0.6 Person Discovery Specification FINAL dated Apr 8, 2004
    - 15 Mar 04: Expert registration API finalized
  - **Consumed**
    - V1.2 Search Web Service Specifications FINAL dated
    - V0.3 Security Services WSDL Specifications FINAL dated Feb 9, 2004

Person Discovery: Architecture



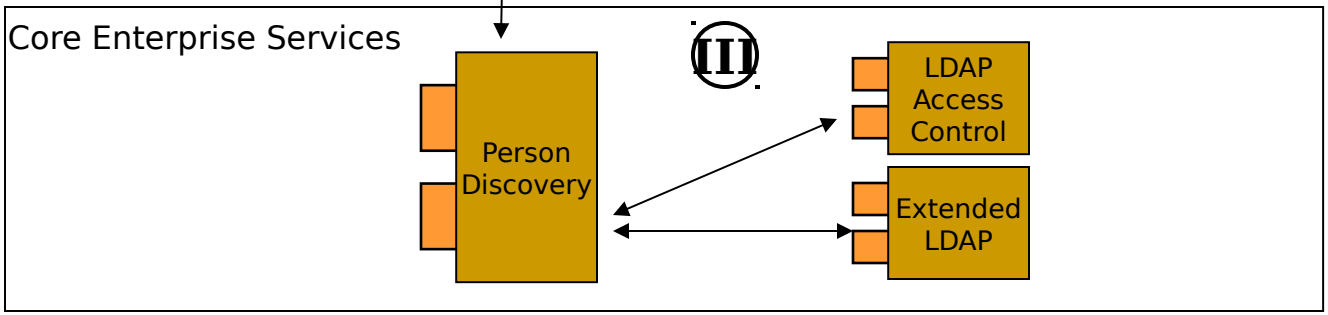
- **More Attributes for extending GDS**
- **Side effect can be Security Roles and Authorization Levels (Enterprise roles for RBAC)**

Person Discovery: Use Case



Actions

- **I – End User accesses the portal to search for a person**
- **II – The Portal Engine receives the user's request and sends it to the People Discovery Service**
- **III – The Query is sent to the LDAP store and the appropriate results are returned**



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Mediation: Messaging

- **Description:**
  - **Provides Enterprise Message Bus**
    - **Asynchronous Event Notification (Alerts, Track Updates, User Notifications, etc.)**
    - **Provide message QoS**
      - **Priority/Precedence**
      - **Time-to-live**
    - **Guaranteed Delivery**
      - **Messages Queued for Delivery to Disconnected Clients**
    - **Distributed**
      - **Multiple Message Brokers**
    - **Federated**
      - **Brokers in Different Administrative Domains**
      - **Different Vendor Implementations**
    - **Supports Pub&Sub, P2P Models**
      - **Java Messaging Service (JMS) Model**
- **Specifications:**
  - **Produced**
    - **Leverage WS-Eventing**
    - **V1.0 Messaging Specification FINAL dated Feb 20, 2004**
  - **Consumed**
    - **V0.3 Security Services SDK FINAL dated Apr 1, 2004**

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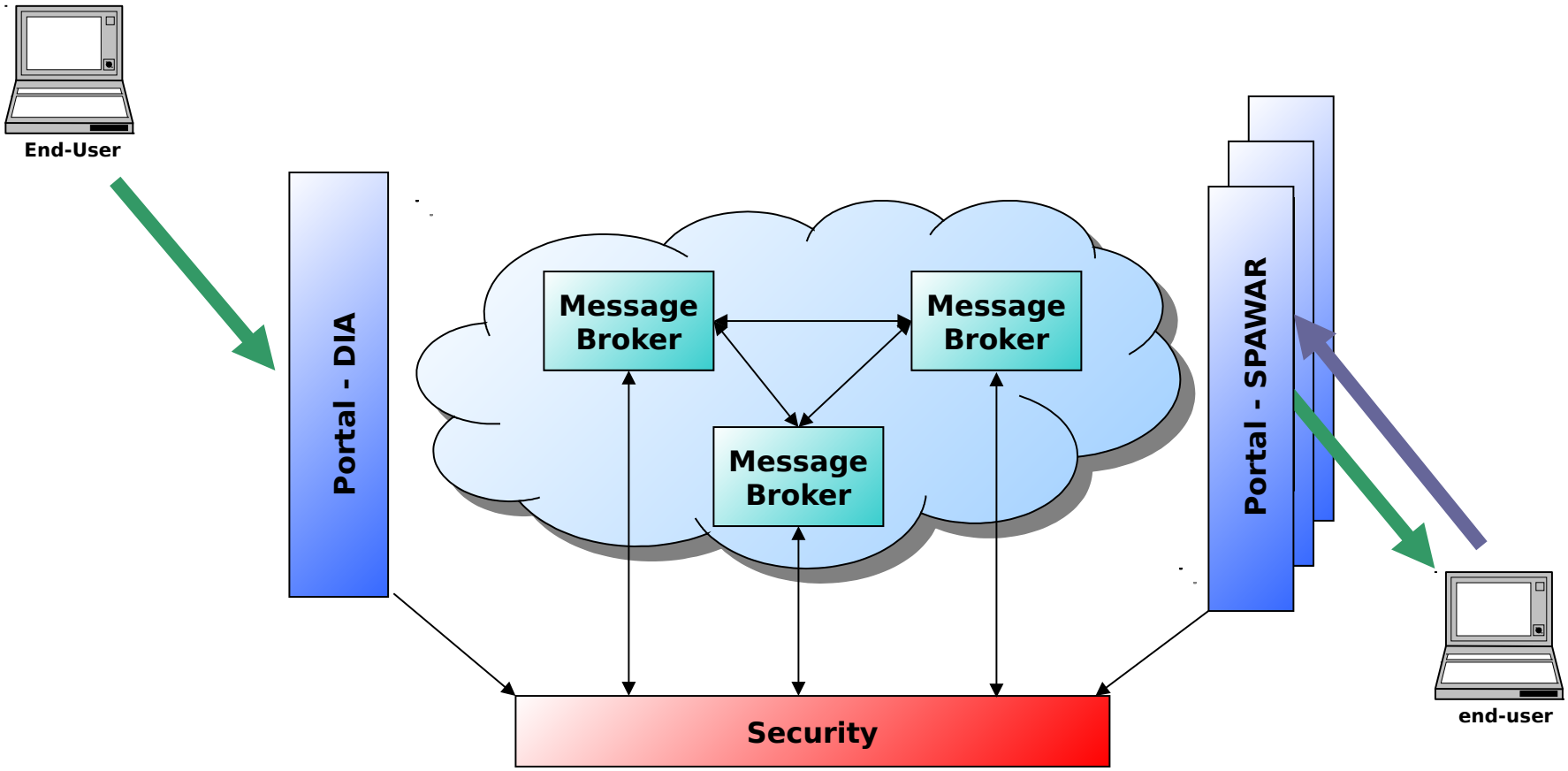
Messaging Use Cases: General Messaging

Mediation: Messaging: Architecture



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Collaboration

- **Description:**
  - **Provides instant messaging, multi-user text chat, white-boarding, audio/video conferencing, and application sharing**
- **Specifications:**
  - **Produced**
    - **V0.4 Horizontal Fusion Collaboration Specification**
  - **Consumed**
    - **XMPP (presence awareness and Chat is XMPP compliant)**
    - **Post QL-2: compliance with T.120 family of protocol standards (for white-boarding, application sharing) and H.323 (audio/video conferencing)**
- **Plan:**
  - **Interoperability with arbitrary XMPP servers/clients**
  - **Integration with expert search, alerts through web service interface**

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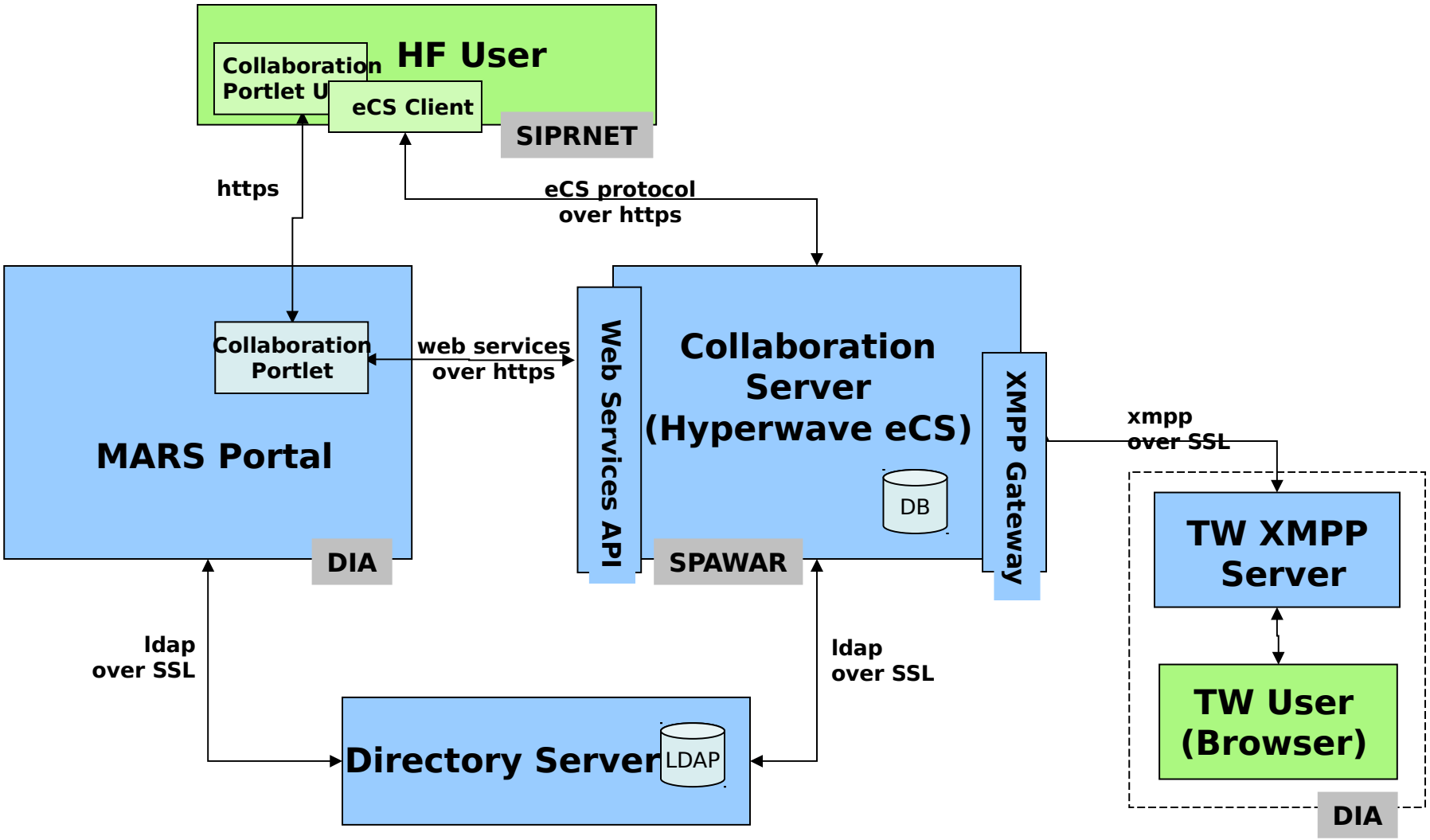
Collaboration: Architecture



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C2 Visualization

- **Description:**
  - **Provide portal-based geographical mapping services**
    - **Mil STD 2525 symbology for track visualization**
    - **DII COE/GCCS integration for track correlation**

- **Plan:**
  - **Web-based COP visualization**
    - **Open source WebCOP / eXtensible Information System**
  - **XTCF is track mediation extraction layer to mapping agency**

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C2 Visualization

- **Specifications:**
  - **Produced**
    - **WMS – OGC Web Map Service for layered geospatial raster images**
    - **WFS – OGC Web Feature Service for XML features (geospatial and attributes)**
    - **OS WebCOP Portlet – DHTML for standard browser interface**
  - **Consumed**
    - **SOAP with XTCF Data Mediation Metadata**
      - **WSDL, XSLT, and Service Metadata mapped to standard Semantic Domain and Type Schemas**
    - **External WFS data**
    - **External WMS images**
    - **WRS – OGC Web Registry Service for browsing/selecting WFS, WMS services**
    - **SQL (JDBC/ODBC), XML, Tabular, raster graphics, other…**

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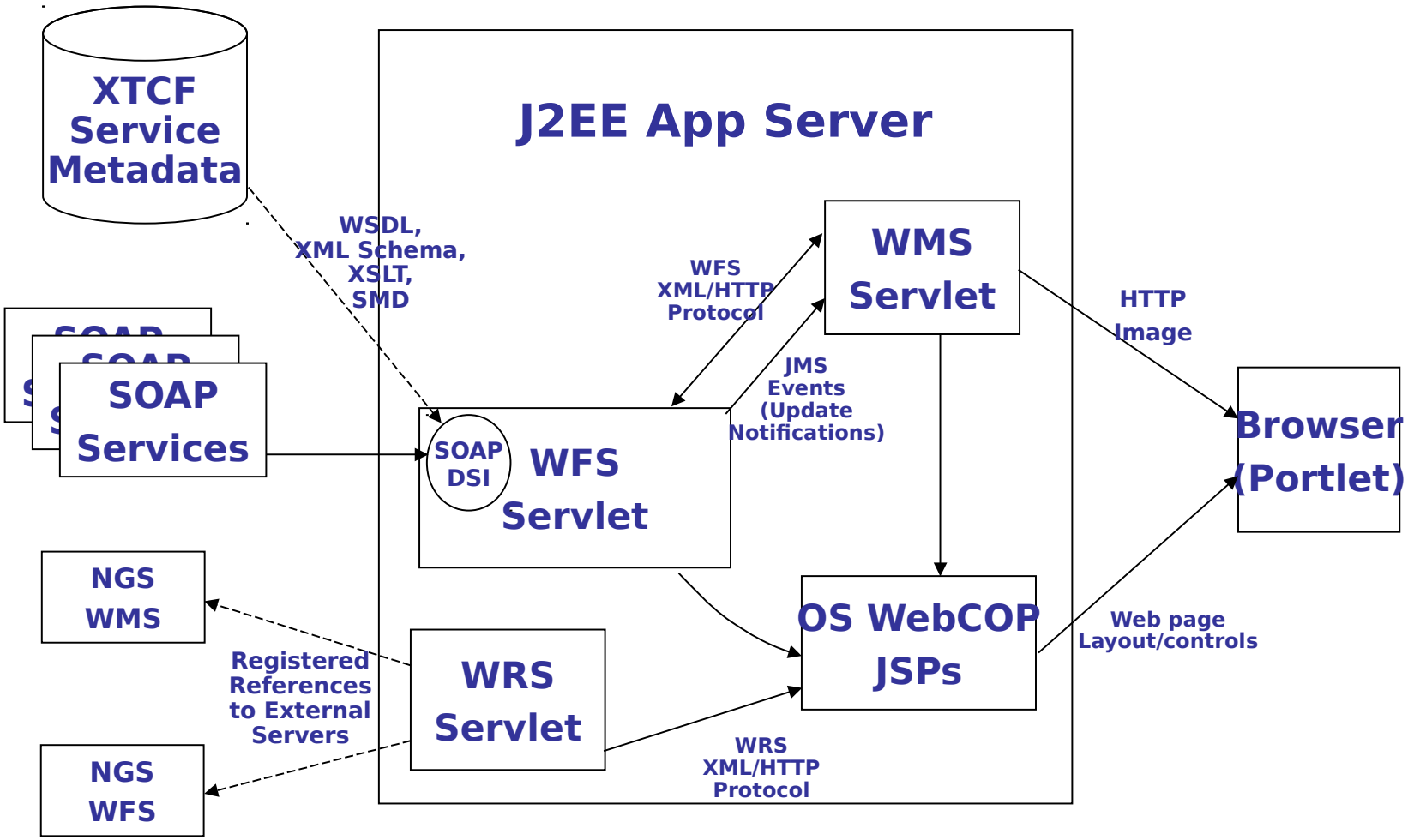
C2 Visualization: Architecture



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ESM: NCES

- **Description:**
  - **ESM capabilities enable HF service and infrastructure providers to know the end-to-end operational (up/down) status of offered (community and core) net-centric services; includes management of servers and infrastructure for supporting NCES operations**

- **Specifications:**
  - **Produced**
    - **Web Service Management (WSM) Taxonomy registered in UDDI V2**
    - **Managed web service end points advertised in UDDI**
  - **Consumed**
    - **UDDI V2 API (V3 Notification feature required)**

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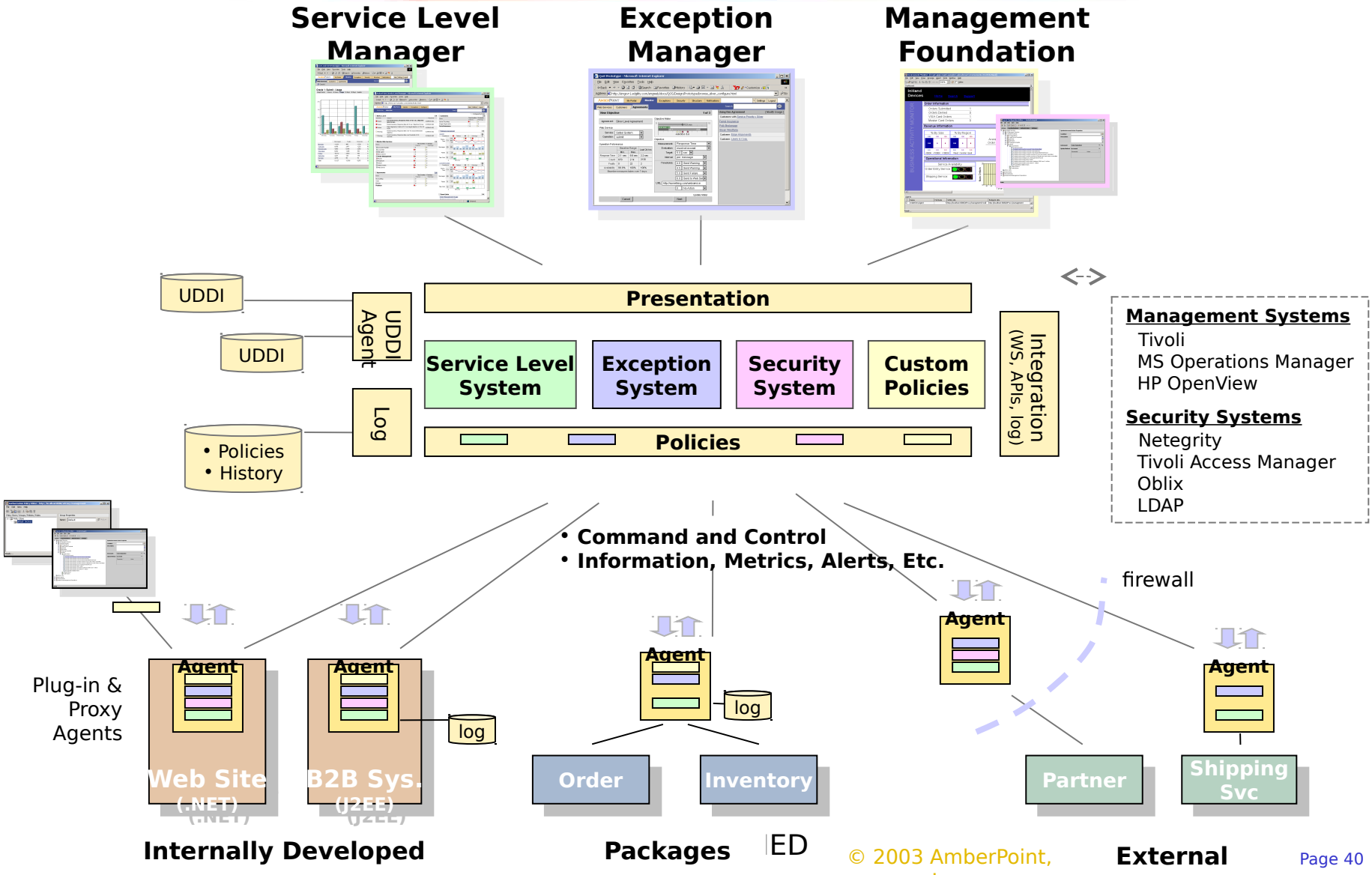
ESM: NCES: AmberPoint Architecture



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ESM: VEM

- **Description:**
  - **Visual Enterprise Monitoring provides a real time view of message traffic posted and consumed within the Collateral Space**
  - **Augments ESM by providing view of how Web Services are being used**
  - **VEM Viewer provides a customer tailored video display showing data density by category, temporal characteristics, consumption, etc.**

- **Specifications:**
  - **Uses WS to collect information from SOAP wrapper and/or metadata from body of messages.**

Horizontal Fusion 2004 Notional Topology

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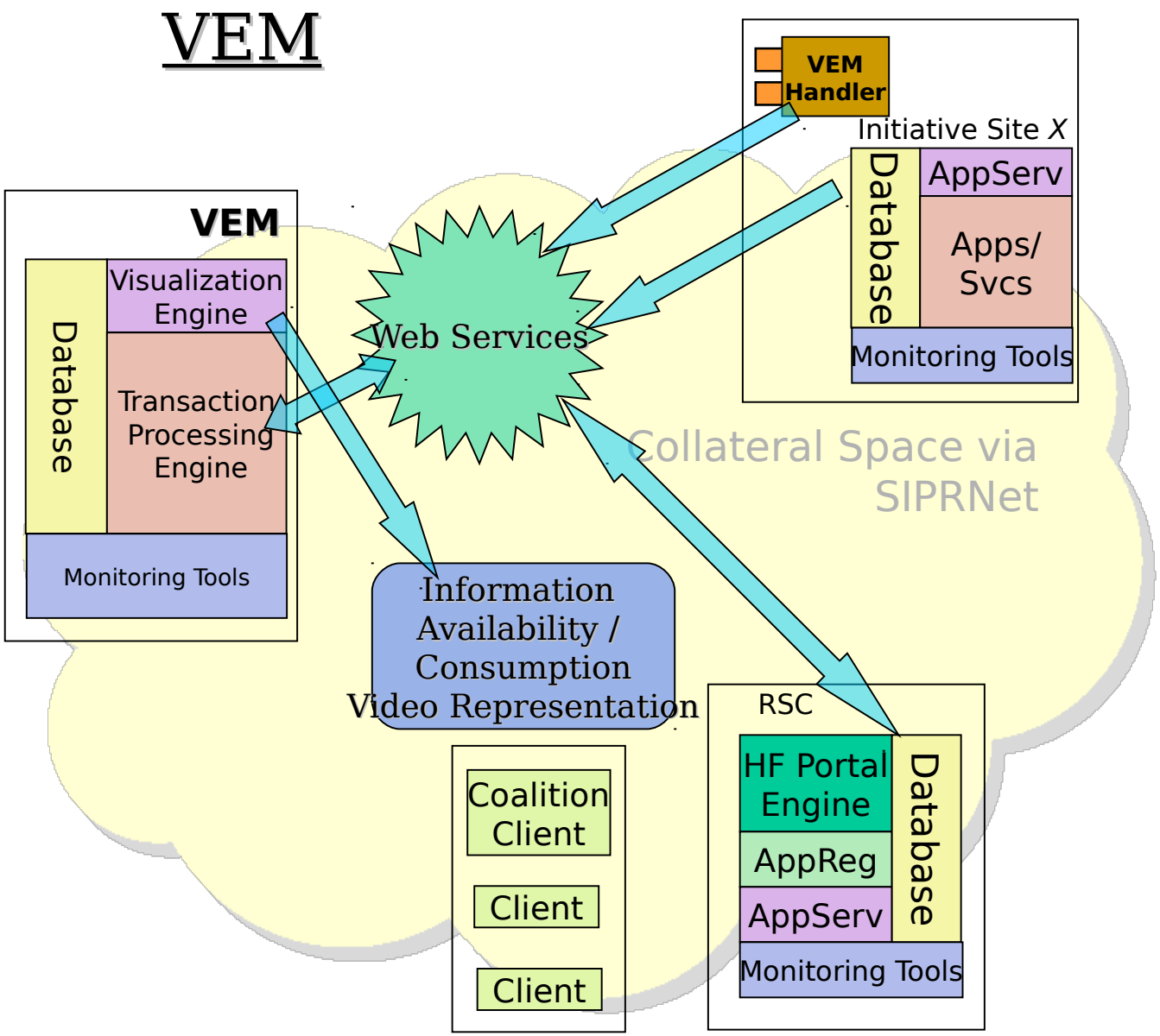

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Metadata Discovery
DoD XML Registry

- **Description:**
  - **Provides the ability to register and discover metadata artifacts (e.g. XML Schemas and Stylesheets) into the DoD Metadata Registry and Clearinghouse**
    - **Web based user interface to register and discover metadata products**
    - **Provides REST based API to access metadata products from applications**
  - **SOAP based API provided in 4.0 release**

- **Specifications:**
  - **Produced**
    - **SOAP and REST based interface specifications**
  - **Consumed**
    - **TBD : NCES Security Services**

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Metadata Discovery/Mediation: Architecture

Developers, Architects, etc

GIG-ES Portal

Metadata Registry Portal

Data Elements Registry

XML Registry

Database Segments Registry

Reference Data Sets Registry

Web Services

WS-I (SOAP)

Application Server / Platform

Database

CORE Services

(Planned)

Systems

Translations Schemas

Transformation Services

Mediation Engine(s)

Metadata Artifacts

Search Services

Data Instance Catalogs(s)

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Mediation: Metadata DoD XML Registry

- **Description:**
  - **Provides an XML translation service based on translations (XSLT Stylesheets) using the DoD Metadata Registry and Clearinghouse metadata products**
  - **Demonstrates use of metadata registry runtime API set**
  - **Web Service Based API**
- **Specifications:**
  - **Produced**
    - **V0.2 XML Translation Service API specification FINAL dated Mar 2, 2004**
  - **Consumed**
    - **XSL Translations and XSD Schemas registered into the DoD Metadata Registry**

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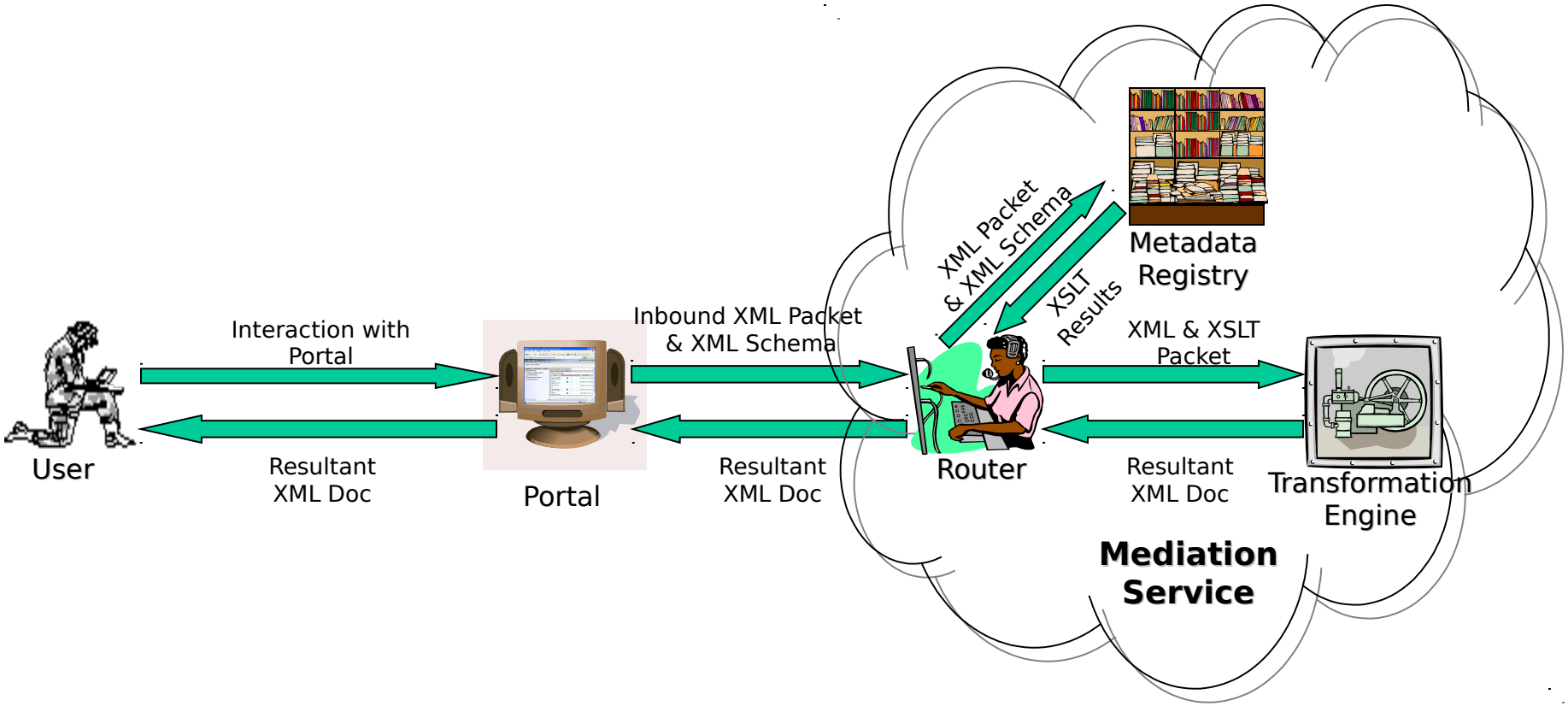
Mediation: Metadata: Use Case

DoD XML Registry



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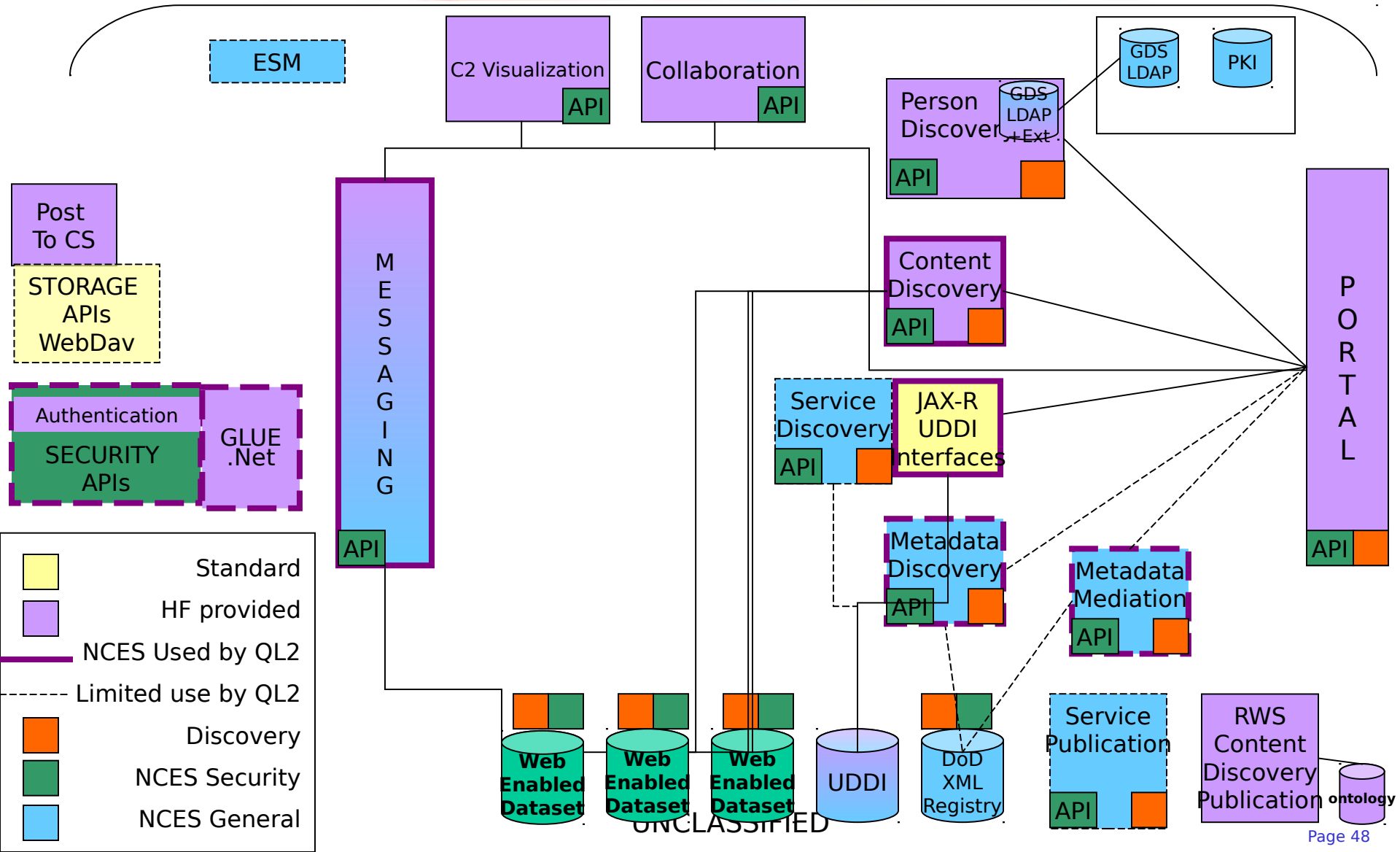
Storage

- **Description:**
  - **Provides a highly connected, highly available persistent community-accessible storage media; focuses especially on the needs of forward edge data providers who may be infrequently connected and using disadvantaged comms**
  - **Horizontal Fusion updating Post to Collateral Space capability to support the WebDAV OASIS standard**

Horizontal Fusion – NCES Pilot Linkages



HORIZONTAL FUSION

What To Take Away

- **These are the Core Services for the Horizontal Fusion Services-Oriented Architecture as it exists today**

- **If you become part of the Horizontal Fusion 2005 Portfolio, you will need to become intimate with this architecture so that:**
  - **You can attach your services/data to the Collateral Space**
  - **Enhance the Core Services**
  - **Fill in missing pieces of the Services-Oriented Architecture**

- **We are interested on building upon this architecture, not in replacing what we already have**
  - **This does not mean that there is not room to improve what we currently have**